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APPLICATION NUMBER: *60/072,032*
FILING DATE: *January 21, 1998*

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(b)(2).

Docket Number	RAP04 P-571	Type a plus sign (+) inside this box →	+

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TITLE OF INVENTION (280 characters max)

HIGH THROUGHPUT DISPATCH SYSTEM FOR MAIL PROCESSING AND DISTRIBUTION CENTER

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ENCLOSED APPLICATION PARTS *(check all that apply)*

- ■ Specification — Number of Pages 12
- ■ Drawing(s) — Number of Sheets 16
- □ Small Entity Statement
- □ Other (specify) _____

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

■ A check or money order is enclosed to cover the filing fees.		
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

■ No.

□ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____ Date January 21, 1998

TYPED or PRINTED NAME Frederick S. Burkhart REGISTRATION NO. *(if appropriate)* 29 288

□ Additional inventors are being named on separately numbered sheets attached hereto.

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PATENT
RAP04 P-571
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Douglas E. Olson, Gerald A. Brouwer, Hans J. Klein, Steven A. Axelrod, Charles R. DeVries, Keith E. Schultz and Bruce A. Young

For : HIGH THROUGHPUT DISPATCH SYSTEM FOR MAIL PROCESSING AND DISTRIBUTION CENTER

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HIGH THROUGHPUT DISPATCH SYSTEM FOR MAIL PROCESSING AND DISTRIBUTION CENTER

BACKGROUND OF THE INVENTION

This invention relates generally to automated sorting and dispatching of mail which is sorted into containers, such as letter trays or tubs, and dispatched to manual carts. In particular, the present invention is directed to a dispatch system for receiving random trays or tubs, each containing sorted letters, and dispatching the containers to particular carts for forwarding to local post offices.

The dispatch operation in an automated mail processing and distribution center has traditionally been a labor-intensive operation. Unsorted mail enters the processing and distribution center and is sorted by automated sorting equipment into individual trays and tubs which must then be dispatched to a cart known as an Eastern Regional Mail Container (ERMC) which is a wheeled container with two fixed and two swivel casters. The trays or tubs contain a bar code in order to identify its destination and may be in either an uncovered condition covered with a sleeve or sleeved and banded.

Efforts have been made to reduce the manual labor associated with the dispatching of the letter trays or tubs. However, such efforts have been met with limited success. One attempt at a dispatch system 1, illustrated in Fig. 1, includes a gantry robot 2 which retrieves letter trays from an accumulation conveyor 3 and places each tray in a particular cart 4. Because the dispatch of each tray is by a robot, there is a commensurate reduction in manual labor. However, the throughput for dispatch system 1 is still not satisfactory. The reason is that the robot is capable of moving only a single tray or tub at a time to a cart. Additionally, safety regulations require that when a cart is full and in need of manual removal from the dispatch system, and replaced with an empty cart, it is necessary to mechanically lock out the robot 2 in order to prevent injury. Therefore, each time a cart is full, it is necessary to shut down the entire dispatch system which further reduces the throughput of the system. While it may be possible to adapt dispatch system 1 such that gantry robot 2 could be merely locked out of operation in the area of the cart being removed rather than completely locked out, such selective lock-out for replacement of carts would be complicated and expensive to accomplish.

Another prior art dispatch system 5 utilizes a pedestal robot 6 which rotates in order to pick up trays from discharge conveyor 8 (Fig. 2) and places them into cart 7. Dispatch system 5

suffers from many of the same limitations as dispatch system 1. When a cart 7 is full, it is necessary to lock out robot 6 while the personnel changes out any of cart 7.

In addition to the limitations set forth above, prior known dispatch systems are limited to handling only mail trays which are sleeved prior to the dispatching operation. This results in a lack of flexibility further restricting usefulness of the prior art systems.

Thus, it would be desirable to provide a dispatch system which significantly increases throughput. It would additionally be desirable to provide a dispatch system which is capable of handling both trays and tubs of various sizes as well as containers which are uncovered, sleeved, or covered with cardboard. All of this should preferably be accomplished in a system which minimizes vertical height because installations often take place in older facilities which have limited ceiling heights. Any such dispatch system must comply with all pertinent safety requirements.

SUMMARY OF THE INVENTION

A high throughput dispatch system, according to an aspect of the invention which dispatches randomly arranged containers of sorted mail to particular dispatch carts, includes a sortation conveyor having a main line defined by a conveying surface, a plurality of spurs extending from the main line, and a diverter mechanism at each of the spurs. The diverter mechanism selectively diverts containers from the conveying surface onto one of the associated spurs. A postal dispatch system, according to this aspect of the invention, further includes at least one transport mechanism which transports containers from each of the spurs to a container juxtaposed with the spur.

The present invention is based upon a recognition that system throughput can be significantly increased by separating the sortation function from the cart-loading function. By separating these functions, it is possible to have a larger number of transport mechanisms, which, when operating in combination, can significantly increase throughput. The greater number of transport mechanisms increases throughput while the system is in full operation. Furthermore, because only the transport mechanism associated with a particular cart needs to be mechanically locked out of operation while that particular cart is being replaced with an empty cart, it is not necessary to lock out the entire system in order to replace a full cart with an empty cart. Thus, system throughput is further enhanced.

A container dispatch system, according to another aspect of the invention, includes a sortation conveyor as previously set forth and a transport mechanism associated with each of the

spurs. The transport mechanism transports containers from the spur to a subjacent cart and includes an extendable support member and vertical lift. The extendable support member is adapted to retrieving containers from the spur and inserting the containers to the associated cart. The vertical lift is adapted to moving the support member between the vertical level of the spur and the vertical level of the cart. The extendable support member is configured in order to advantageously be able to handle more than one size of container. This allows the transport mechanism to transport trays and tubs of various dimensions. Advantageously, the extendable support member engages the underside of the container which allows the system to handle both covered and uncovered containers.

A method of dispatching randomly ordered containers of sorted mail to carts, according to another aspect of the invention, includes sorting containers to particular locations, each location associated with a cart and transporting containers between each of such particular locations and the associated cart.

These and other objects, advantages and features of this invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top plan view of a prior art dispatch system;

Fig. 2 is the same view as Fig. 1 of another prior art dispatch system;

Fig. 3 is a top plan view of a high throughput dispatch system, according to the invention;

Fig. 4 is an enlarged view of the area illustrated in phantom and designated IV in Fig. 3;

Fig. 5 is a dispatch subsystem;

Fig. 6 is a sectional view taken along the lines VI-VI in Fig. 5;

Fig. 7 is a side elevation taken along the lines VII-VII in Fig. 5;

Fig. 8 is a rear elevation of a transport mechanism;

Fig. 9 is a side elevation of the transport mechanism in Fig. 8;

Fig. 10 is a side elevation of an extendable support member of a transport mechanism;

Fig.11 is a top plan view of the support member in Fig. 10;

Fig. 12 is a side elevation illustrating safety caging around a transport mechanism;

Fig. 13 is a top plan view illustrating safety caging around several adjacent transport mechanisms;

Fig. 14 is a rear end side elevation of a cart loaded with a particular type of tray;

Fig. 15 is a rear end side elevation of a cart loaded with a particular type of tub;

Figs. 16a-16d are perspective views of various containers which can be dispatched with the dispatch system;

Figs. 17a-17c are rear elevations of sortation spurs used with different types of containers; and

Fig. 18 is a top plan view of an alternative embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now specifically to the drawings, and the illustrative embodiments depicted therein, a high throughput dispatch system 20 as illustrated in Fig. 3 may include a plurality of dispatch subsystems 22. The number of subsystems may be selected according to the particular application. In the illustrated embodiment, mail is sorted onto trays using conventional sorting equipment (not shown) and delivered to a merge area 24, shown in phantom, which feeds a sortation subsystem 26, also shown in phantom, which diverts individual trays of sorted mail to each dispatch subsystem 22 as well as to one or more optional manual dispatch areas 28, also shown in phantom. As will be explained in more detail below, the dispatch system 20 automatically dispatches the trays of sorted letters to conventional ERMC or similar USPS rolling stock.

In the illustrated application, the letter trays may be sleeved and banded or unsleeved prior to dispatching. Accordingly, as illustrated in Fig. 4, the take off lines of the sortation subsystem 26 lead to manual predispatching operations illustrated in phantom at 30. It is to be understood that in other applications such predispatching operations may not be provided. From the predispatching operation 30, an input conveyor 32, which, in the illustrated embodiment, is made up of an incline belt conveyor 34a, a turn conveyor 34b, an incline belt conveyor 34c, and a "no read" discharge chute 34d, intersects with a sortation line 36. Either scanner 38a or 38b reads bar codes (not shown) on the sides of mail containers, and, if a successful read occurs, a diverter 40 diverts the container onto sortation line 36. If a successful read does not occur, the container continues to chute 34d.

Once on sortation line 36, the container travels past a series of diverters 42 (Fig. 5). Each diverter 42 is adapted to diverting containers laterally off the conveying surface of sortation line 36 onto a spur 44. In the illustrated embodiment, a pair of spurs 44 are positioned on opposite sides of sortation line 36 in which case, diverter 42 is a bidirectional diverter. It should be understood that, in other applications, the spurs may be arranged on a single side of sortation

line 36, in which case diverter 42 is a unidirectional diverter. In the illustrated embodiment, the conveying surface of sortation line 36 is made up of a multiplicity of generally parallel powered rollers. Diverter 40 and 42 is a powered pop-up diverter. The powered roller conveyor is preferably a line-shaft conveyor of the type commercially available from Mannesmann Dematic Rapistan Corp., although other powered roller conveyors or other powered conveying surfaces may be utilized. Although in the illustrated embodiment diverters 40, 42 are pop-up belt driven diverters, other diverters, such as wheel diverters, positive displacement diverters, pushers, and the like, may be utilized. In the illustrated embodiment, sortation line 36 is in the form of a closed circuit. This configuration provides for recirculation of containers which are unable to be diverted upon their first pass for whatever reason. In such configuration, sortation line 36 includes semicircular end sections 46 which are made from belt turn conveyors of the type manufactured by Mannesmann Dematic Rapistan Corp. It should be understood that sortation line 36 could, alternatively, be oriented in a straight line or any other geometric layout suitable to the application.

Each dispatch subsystem 22 includes one or more transport mechanisms 50. Each transport mechanism 50 transports containers from one of the spurs 44 to a cart 52 positioned subjacent to the associated spur (Figs. 6 and 7). Each transport mechanism 50 includes an extendable support member 54 (Fig. 7) which retrieves containers from the associated spur and which inserts the containers into the associated cart 52. Transport mechanism 50 additionally includes a vertical lift 56 which moves support member 44 between the vertical level of the associated spur 44 and the vertical level of the associated cart 52. Vertical lift 56 includes a pair of vertically oriented beams 58 and a trolley 60 which is supported for traveling along the length of beams 58 (Figs. 8 and 9). A plurality of spaced apart sheaves 62 rotatably supports a belt 64 whose ends 66 are attached to trolley 60. A servo-controlled motor 68 rotates the upper sheave 62 thereby moving belt 64 and trolley 60 attached thereto. A counterweight 70, which is sized to the weight of trolley 60 plus half of the anticipated load, is attached to belt 64 opposite trolley 60 in order to reduce the amount of torque required from motor 68.

Extendable support member 54 includes a container lift member 72 which is extendable along tracks 74 and a stripper 76 which is selectively movable with respect to lift member 72 along tracks 84 (Figs. 10 and 11). Lift member 72 includes a car 78 which rides horizontally along tracks 74 and a set of fingers 80 which are adapted to engaging containers in a manner that will be set forth in more detail below. Stripper 76 includes an abutment 82 and a car 84 which

rides along tracks 85 independently of lift member 72. First and second motors 86 control the respective movement of cars 78 and 84 in order to selectively extend and retract lift member 72 and stripper 76. In particular, lift member 72 and stripper 76 extend and retract together in order to lift one or more containers from a spur 44 and to deposit the container or containers on the associated cart 52. Alternatively, stripper 76 may remain stationary while lift member 72 extends. Once the container, or containers, has been deposited on the cart, stripper 76 remains stationary while lift member 72 retracts in order to prevent the container or containers from retracting with the lift member. In the illustrated embodiment, motors 86 are variable frequency motors in order to provide precise control over acceleration of lift member 72 and stripper 76. Preferably, motors 86 are controlled in such a manner in order to provide a constant acceleration during a first half of the travel and a constant deceleration during a second half of the travel of the members.

As illustrated in Fig. 13, each transport mechanism has a docking station 100 associated therewith. Docking station 100 has grooves (not shown) to accommodate wheels of carts 52 and is movable in the direction of arrow 104 to allow a cart to be wheeled on and off the docking station. Docking station 100 further includes an alignment device 102 positioned adjacent the cart in order to align packages being inserted in the cart. In the illustrated embodiment, alignment device 102 is funnel shaped.

Each spur 44 is made up of a frame and a series of rollers 90 which may be gravity rollers or powered rollers (Figs. 17a-17c). A series of slots 92 are formed in frame 88 between rollers 90. Fingers 80 are configured to pass through slots 92 of the spur 44 as the lift member 72 extends and elevates in order to retrieve containers from the associated spur 44. This configuration allows the dispatch system to handle various sizes of containers. Fig. 17a illustrates the dispatch system handling a tray 94a having sloped sides. Fig. 17b illustrates the dispatch system handling a tray 94b having straight sides. Fig. 17c illustrates the dispatch system handling a tub 94c which is significantly larger than trays 94a and 94b. As illustrated in Fig. 14, trays 94a and 94b are arranged on carts 52 in single file with three columns of four trays each. In contrast, Fig. 15 illustrates that tubs 94c are arranged in double file depth with two columns of two-high each. Dispatch system 20 can handle interchangeably both trays and tubs as follows.

When trays 94a, 94b are being dispatched, the associated diverter diverts trays onto a spur 44 until a particular number of trays, such as three trays, are diverted. At that time, lift

member 72 retrieves the three trays and vertical lift 56 lowers the lift member to the appropriate height with respect to the cart 52. The lift member is extended along with the stripper above the previously deposited trays as illustrated in the left view of Fig. 7, and the lift member is retracted while the stripper is maintained in its extended position in order to deposit the trays.

In contrast, when tubs 94c are being handled by dispatch system 20, a diverter 42 diverts tubs to the appropriate spur 44 until a particular number of tubs, such as two tubs, have been diverted to that spur. At that time, lift member 72 is extended and the two tubs are lifted onto the lift member and the lift member is retracted from the spur. However, the vertical lift does not move the extendable support member at that time. After the divert 42 has diverted two more tubs to spur 44, the lift member is, again, extended and the remaining two tubs are loaded onto the lift member along with the previously two loaded tubs. At this time, the vertical lift lowers the extendable support member to the appropriate elevation with respect to cart 52 and the entire four tubs are loaded onto the cart in the manner previously described.

This cycle of diverting trays or tubs onto spurs and transporting the containers between each of the spurs and the associated cart continues until a particular cart is full. At that time, the transport mechanism associated with that cart is mechanically electrically locked out from operation and thereby inhibited from further movement. As illustrated in Figs. 12 and 13, each cart area including transport mechanism 50 is surrounded with a fence 96 having a movable gate 98. When a cart 52 is full, gate 98 is opened and the cart is withdrawn and an empty cart inserted in its place. Once gate 98 is, again, closed, the associated transfer mechanism 50 is enabled for operation. An advantage of this arrangement is that only one transport mechanism 50 needs to be locked out when a cart is full with the remaining transport mechanisms and spurs operational to sort and transport containers. This greatly increases throughput because it is not necessary to shut down the entire dispatch subsystem every time a cart is full.

Thus, it is seen that the invention provides a unique dispatch system for use with a mail processing and distribution center which dispatches sorted containers of letters which are randomly presented to the dispatch system to appropriate carts for dispatching to individual post offices or other USPS facilities. By separating the sorting and transporting functions, a dispatch system according to the invention allows each function to take place at its necessary pace without interfering with the pace of the other function. Furthermore, the transportation function can be subdivided into as many transportation units as necessary in order to balance with the load of the sortation function. Additionally, this allows the system to continue operating at

virtually full capacity even when one or more full carts are being exchanged with empty carts. Furthermore, the invention can be carried out in a relatively low ceiling height. Advantageously, a dispatch system, according to the invention, can handle numerous sizes and shapes of containers as well as containers which are sleeved and unsleeved. This greatly increases the versatility of the system.

Various alternatives are possible. For example, rather than vertically transporting containers from the spur to a subjacent cart, it is within the scope of the invention to elevate the cart with respect to the spur and transfer containers directly from the spur to the cart. While such configuration may reduce cycle time, it results in an overall increase in the height of the system. This embodiment may be desirable where ceiling height is not a significant factor.

In another alternative embodiment illustrated in Fig. 18, a dispatch system 20' includes a sortation line 36' which is illustrated as a unidirectional divert but also could be a bidirectional divert. Sortation line 36' includes a plurality of diverters 42' each associated with a spur 44'. Diverter 42' both diverts containers off from sortation line 36' and transports containers at a right angle from the initial divert onto spur 44'. In this embodiment, a plurality of transport mechanisms 50' are provided, but each transport mechanism 50' is movable between a given plurality of spurs 44'. Thus, when a particular spur is full, the transport mechanism 50' moves to that spur, transports the row of containers to the subjacent cart (not shown), and inserts the containers onto the cart. The transport mechanism 50' is then free to move to another spur to transfer its load. In dispatch system 20', it would be necessary to disable the transport mechanism 50' when any one of the multiple carts being serviced thereby is full. Therefore, dispatch system 20' may have a somewhat reduced throughput, but at a cost savings.

Changes and modifications in the specifically described embodiments can be carried out without departing from the principles of the invention, which is intended to be limited only by the scope of the appended claims, as interpreted according to the principles of patent law including the doctrine of equivalents.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A postal dispatch system which dispatches randomly arranged containers of sorted mail to particular dispatch carts, comprising:

a sortation conveyor having a main line defined by a conveying surface, a plurality of spurs extending from said mail line and a diverter mechanism at each of said spurs which selectively diverts containers from said conveying surface onto the associated one of said spurs; and

at least one transport mechanism which transports containers from each of said spurs to a container juxtaposed with that spur.

2. The system in claim 1 wherein said conveying surface is a continuous loop.

3. The system in claim 2 including another diverter mechanism which diverts containers from a feed line onto said conveying surface.

4. The system in claim 1 wherein said at least one transport mechanism lowers containers from each of said spurs to a subjacent cart associated with that spur.

5. The system in claim 4 wherein said at least one transport mechanism includes a plurality of stationary transport mechanisms, one associated with each of said spurs.

6. The system in claim 4 wherein said at least one transport mechanism travels between plural ones of said spurs.

7. The system in claim 1 wherein said at least one transport mechanism raises a subjacent cart associated with that spur to the level of that spur and moves containers directly from the spur to the cart.

8. A container dispatch system, comprising:

a sortation conveyor having a main line defined by a conveying surface, a plurality of spurs extending from said mail line and a diverter mechanism at each of said spurs which selectively diverts containers from said conveying surface onto the associated one of said spurs; and

a transport mechanism associated with at least one of said spurs which transports containers from said at least one of said spurs to a subjacent cart, said transport mechanism including an extendable support member and a vertical lift, said extendable support member adapted to retrieving containers from said at least one of said spurs and inserting containers to the associated cart and said vertical lift adapted to moving said support member between the vertical level of said one of said spurs and the vertical level of the associated cart.

9. The system in claim 8 wherein said extendable support member includes a plurality of fingers which comb between portions of said at least one of said spurs below containers supported on that spur.

10. The system in claim 9 wherein said spur includes a conveying surface made up of a plurality of roller members and wherein said fingers comb between said roller members.

11. The system in claim 9 wherein said vertical lift elevates said fingers upwardly in order to retrieve a container from said one of said spurs.

12. The system in claim 11 wherein said vertical lift elevates said fingers downwardly in order to insert a container to the associated cart.

13. The system in claim 8 wherein said extendable support member is extended according to a controlled acceleration profile.

14. The system in claim 13 wherein said extendable support member is extended by a variable frequency motor.

15. The system in claim 8 wherein said vertical lift is servo controlled.

16. The system in claim 8 including a plurality of said transport mechanisms wherein each of said transport mechanisms is inhibited from operation when a cart serviced by that transport mechanism is being replaced.

17. The system in claim 16 wherein other transport mechanisms are not inhibited from operation when one of said transport mechanisms is inhibited from operation.

18. The system in claim 8 wherein said conveying surface is defined by a plurality of powered rollers.

19. The system in claim 18 wherein said conveying surface is defined by a line shaft conveyor.

20. The system in claim 8 wherein each of said diverters is a pop-up diverter.

21. The system in claim 8 wherein said spurs are arranged on both sides of said conveying surface and wherein each of said diverters is bidirectional.

22. The system in claim 8 including an alignment device positioned adjacent each of said carts which aligns containers being inserted to the associated cart.

23. The system in claim 22 wherein said alignment device is funnel shaped.

24. A method of dispatching randomly ordered containers of sorted mail to carts, comprising:

sorting containers to particular locations, each associated with a cart; and

transporting containers between each of said particular locations and the associated cart.

25. The method of dispatching in claim 24 wherein said transporting includes accumulating a layer of containers at a particular location and transporting said layer between that location and the associated cart.

26. The method of dispatching in claim 25 wherein said accumulating a layer includes accumulating a row of containers at said particular location, shifting the row of containers and accumulating another row of containers at said particular location.

27. The method of dispatching in claim 24 wherein said sorting containers includes providing a sortation conveyor having a main line defined by a conveying surface and a plurality of spurs positioned along said main line and further includes diverting containers from said conveying surface to spurs at said particular locations.

28. The method of dispatching in claim 24 wherein said transporting containers includes positioning an associated cart below the associated location and causing relative movement between containers at the particular location and the associated cart.

29. The system in claim 9 wherein said fingers are extendable horizontally in order to engage a container.

30. The system in claim 29 wherein said extendable support member further includes a stripper member extendable horizontally independently of said fingers in order to slide containers off of said fingers.

PRIOR ART

1

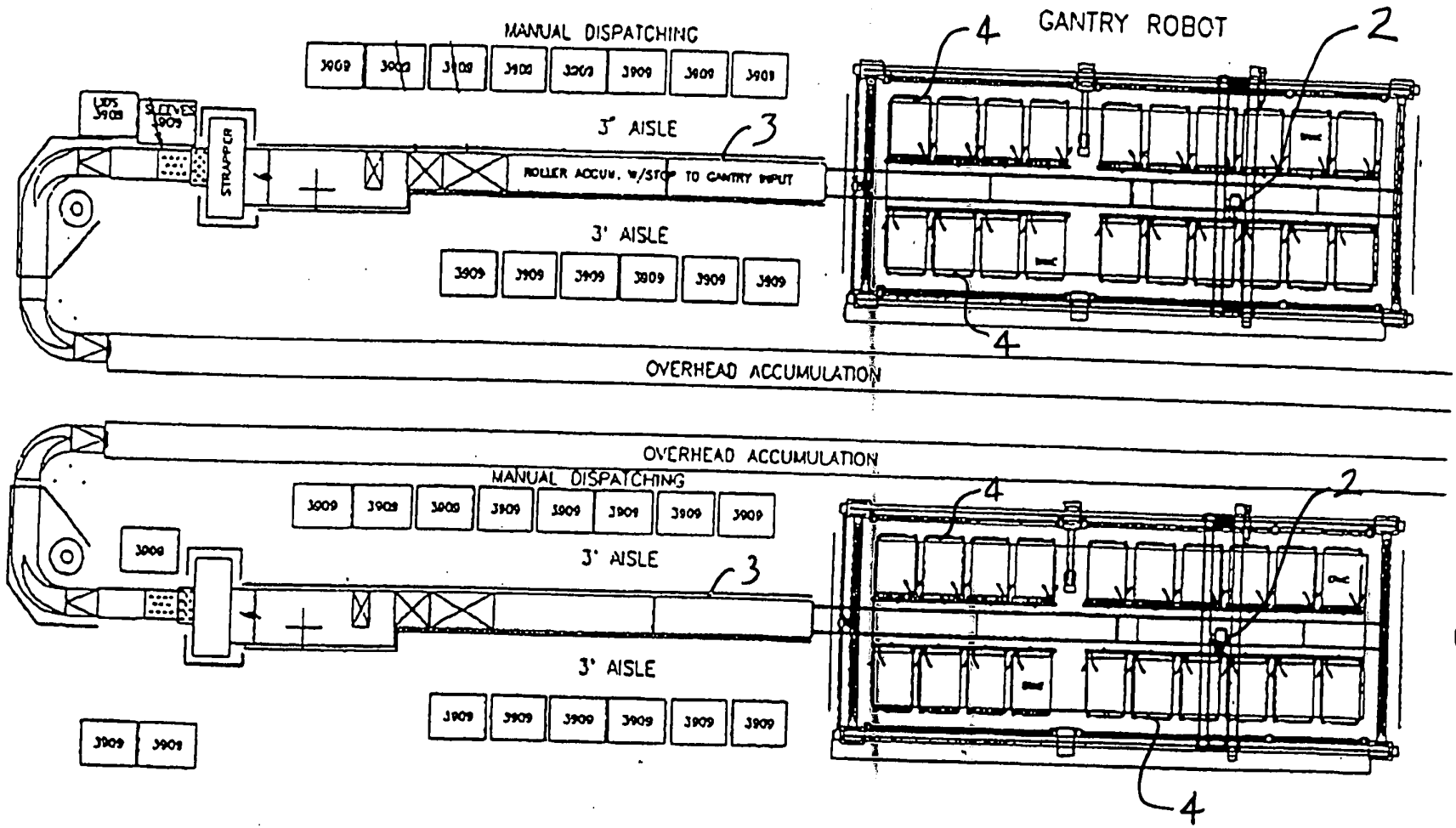


Fig 1

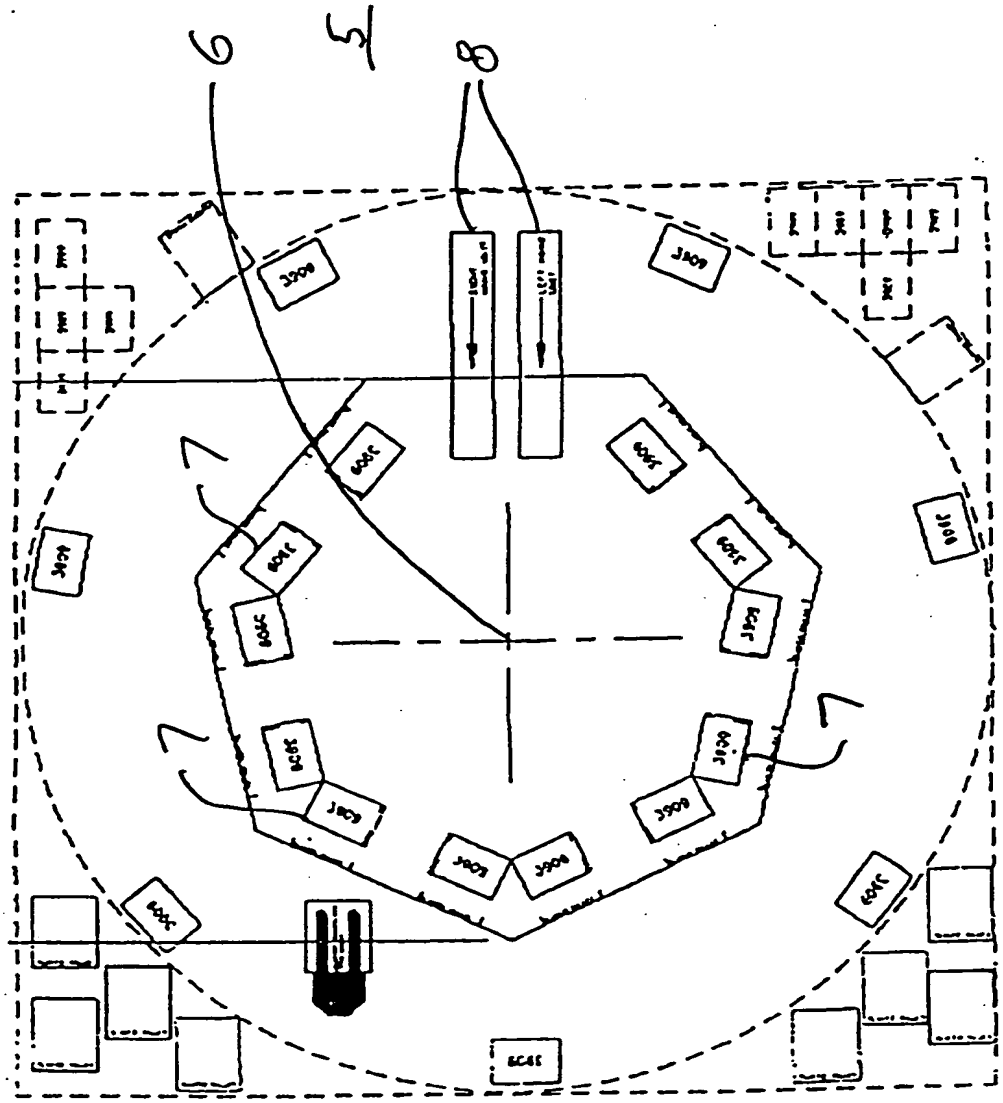


Fig 2

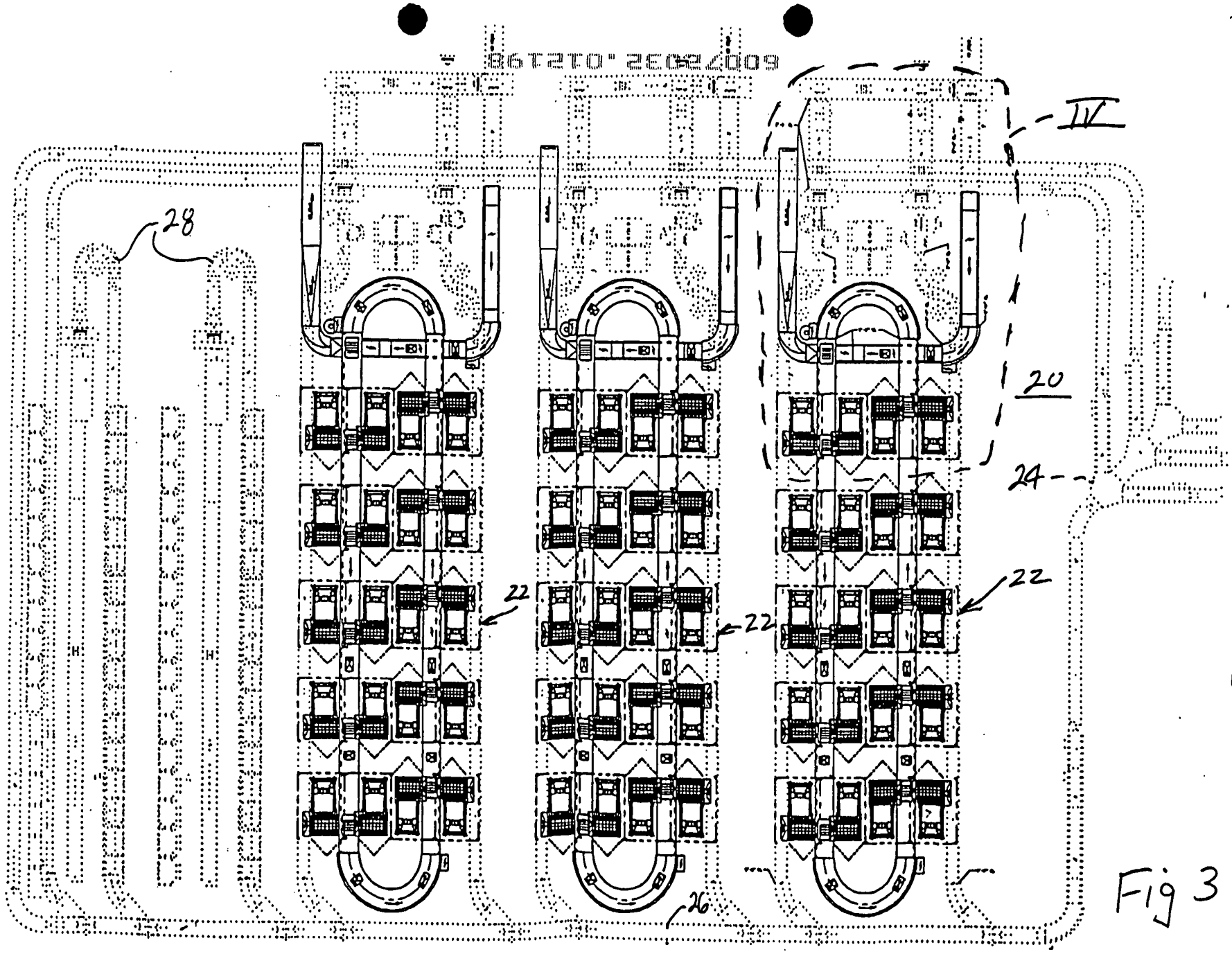


Fig 3

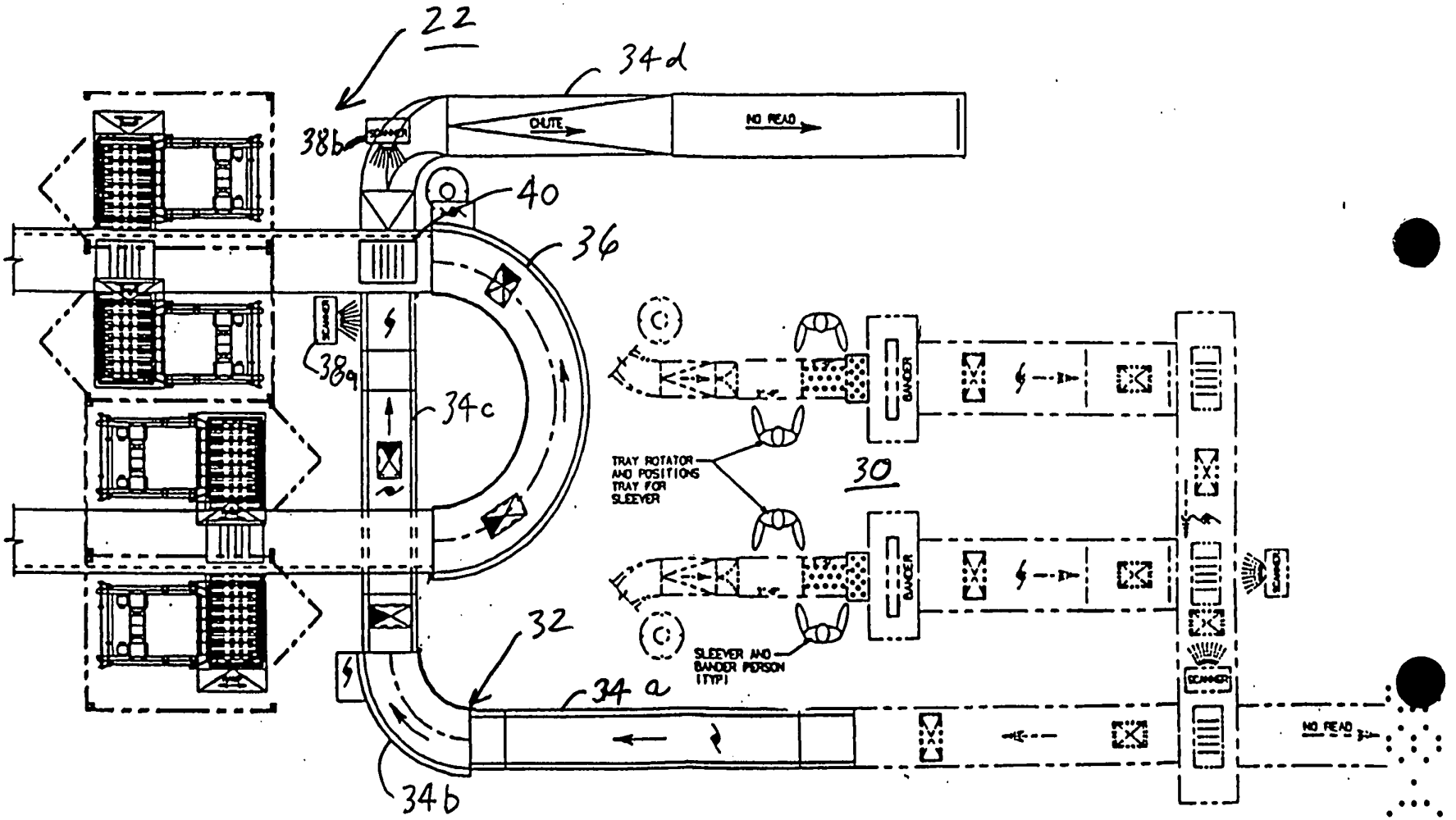
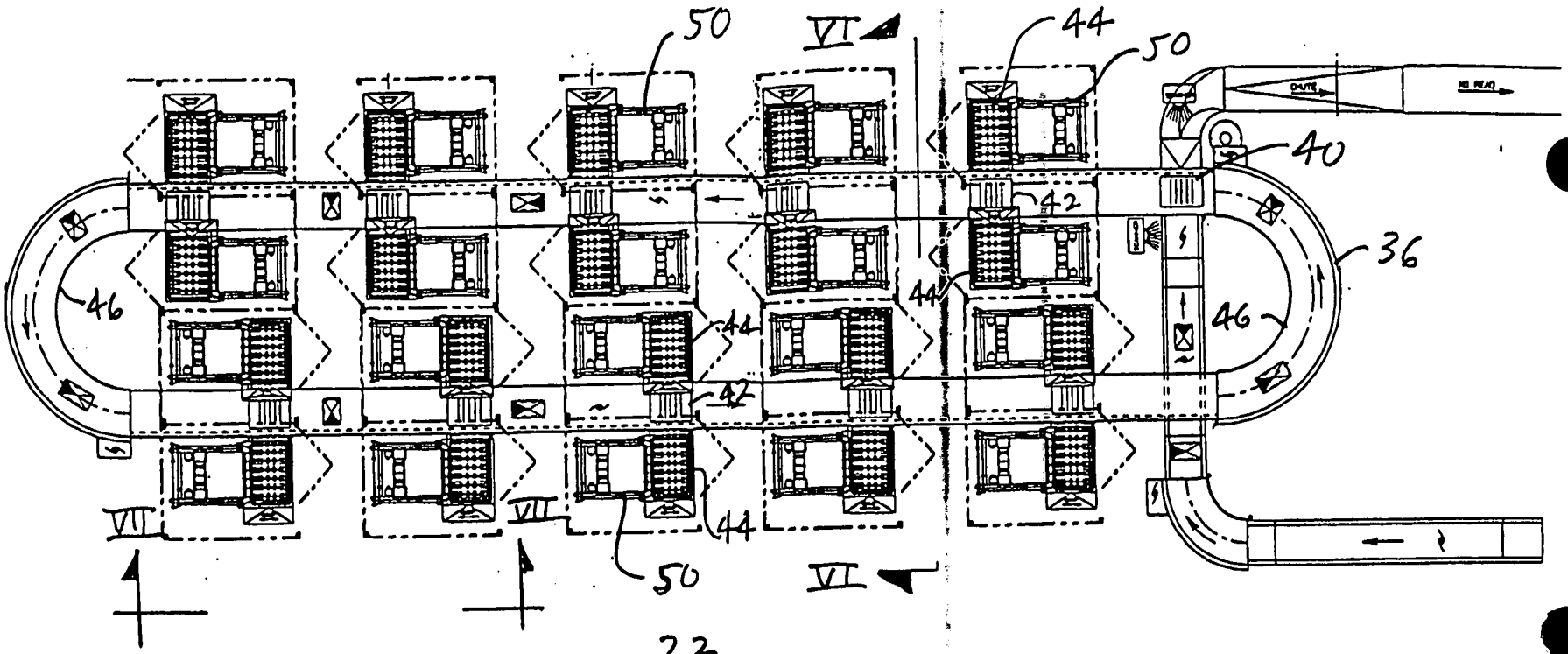


Fig 4



22

Fig 5

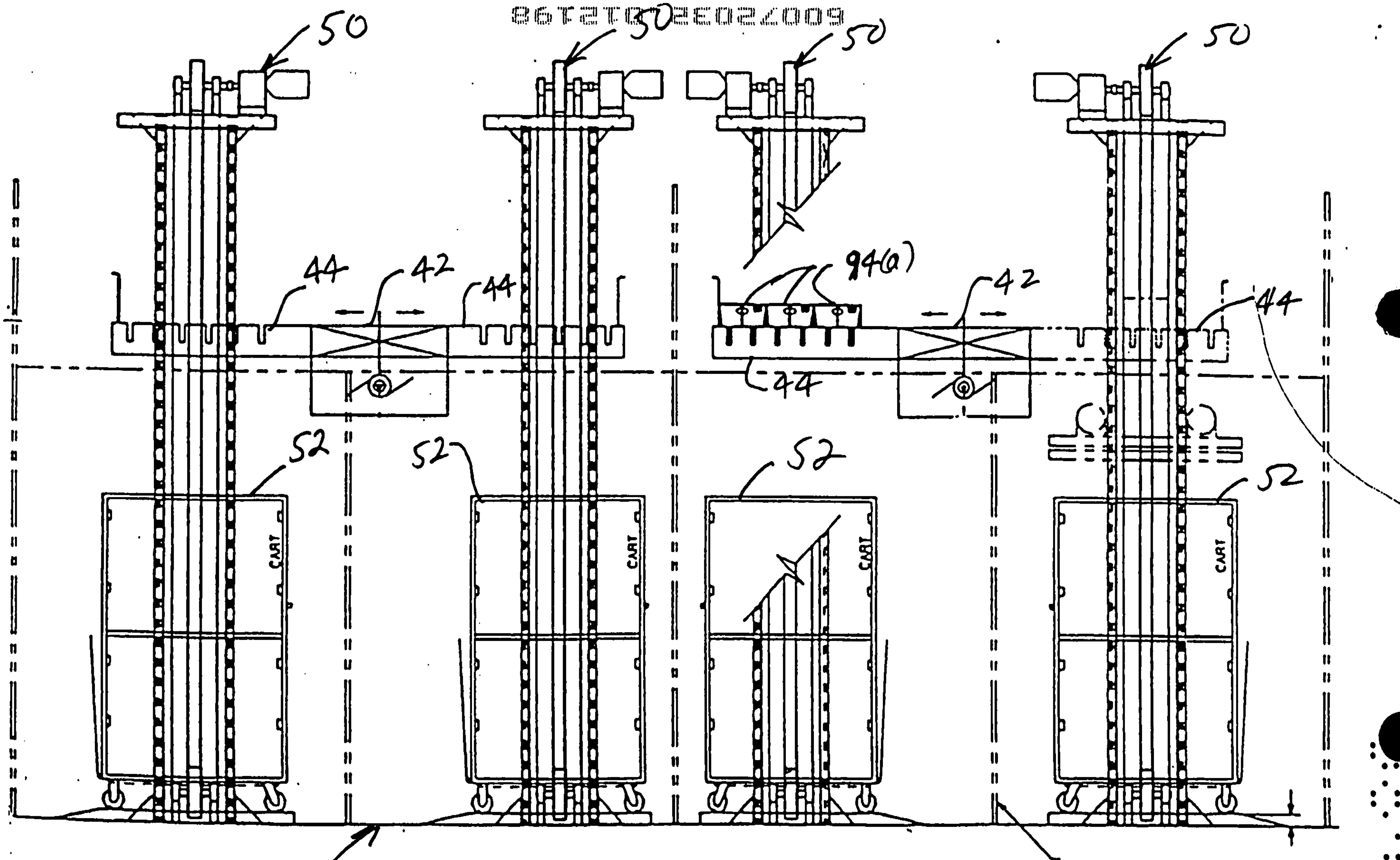


Fig6

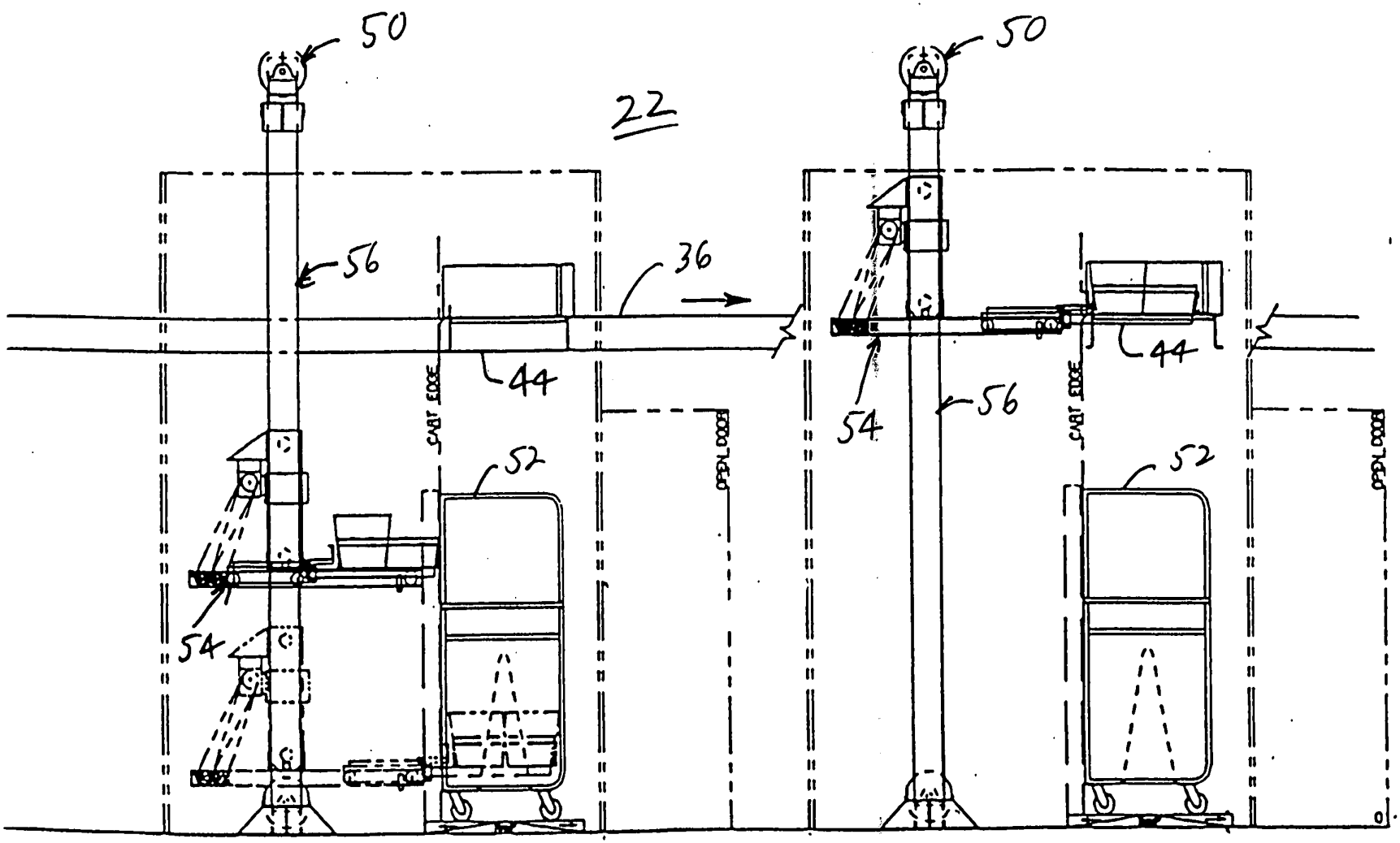


Fig 7

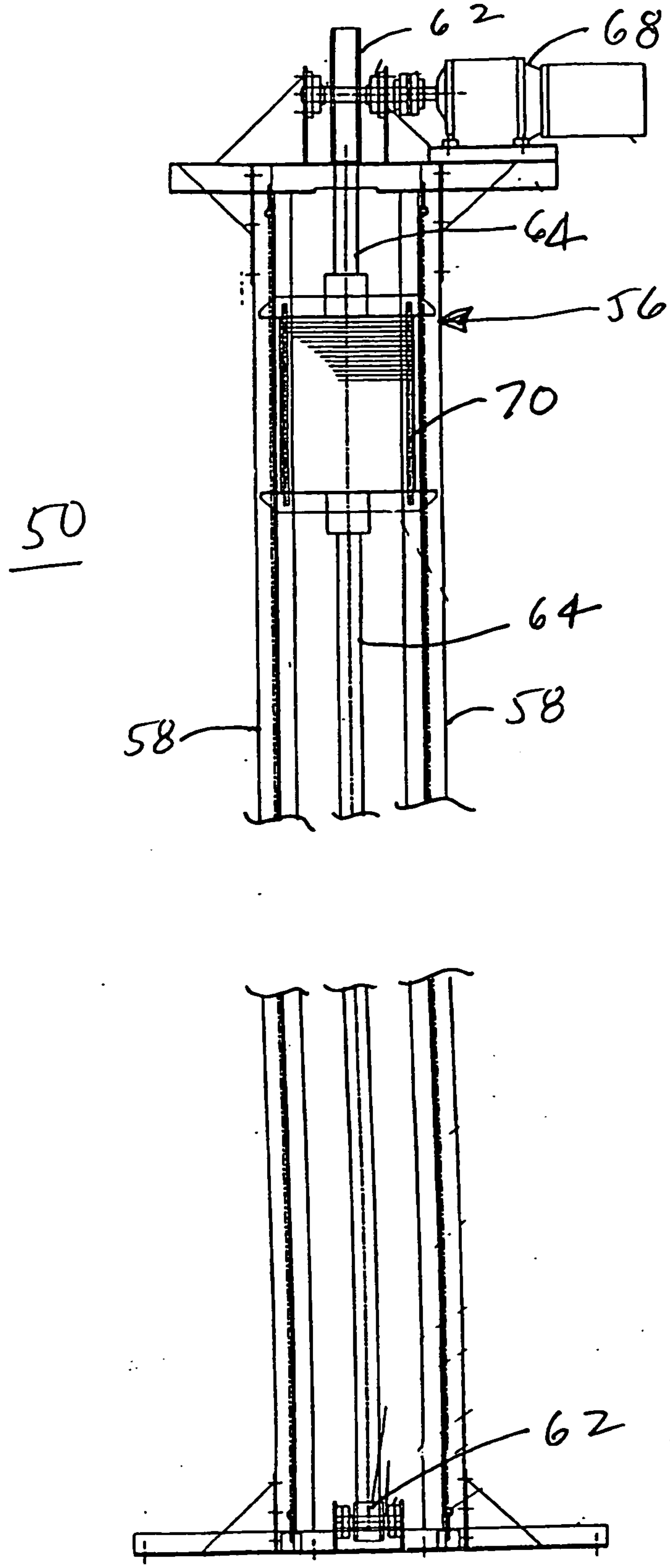
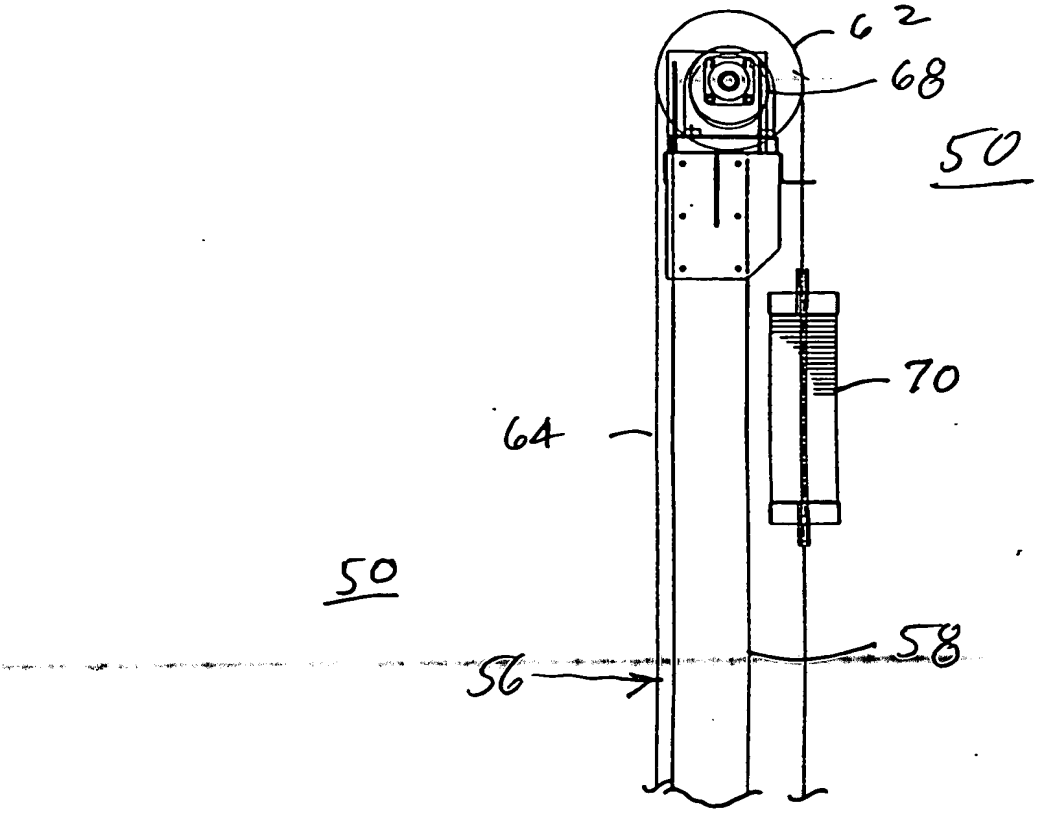


Fig 8



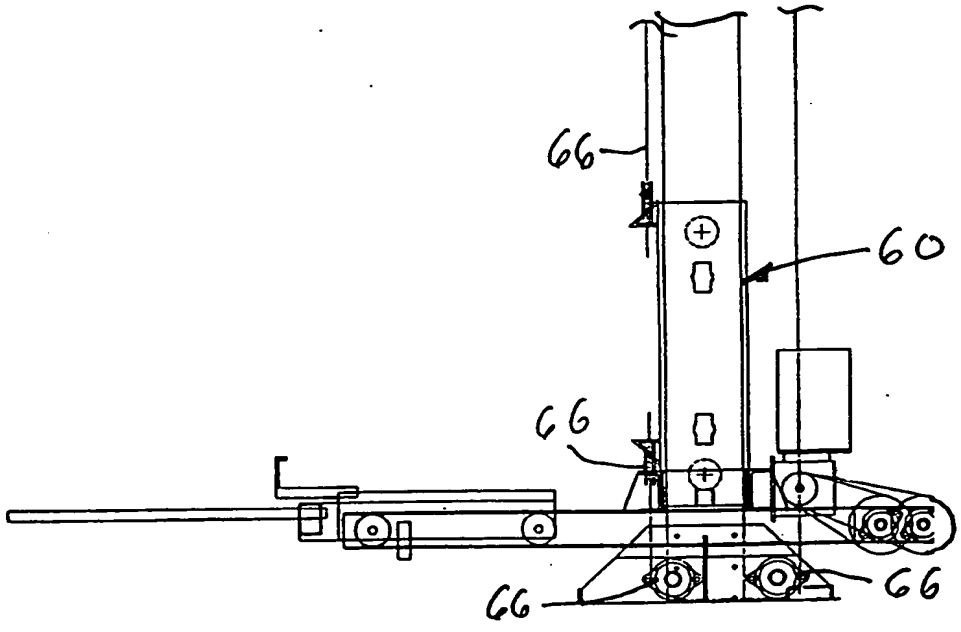


Fig 9

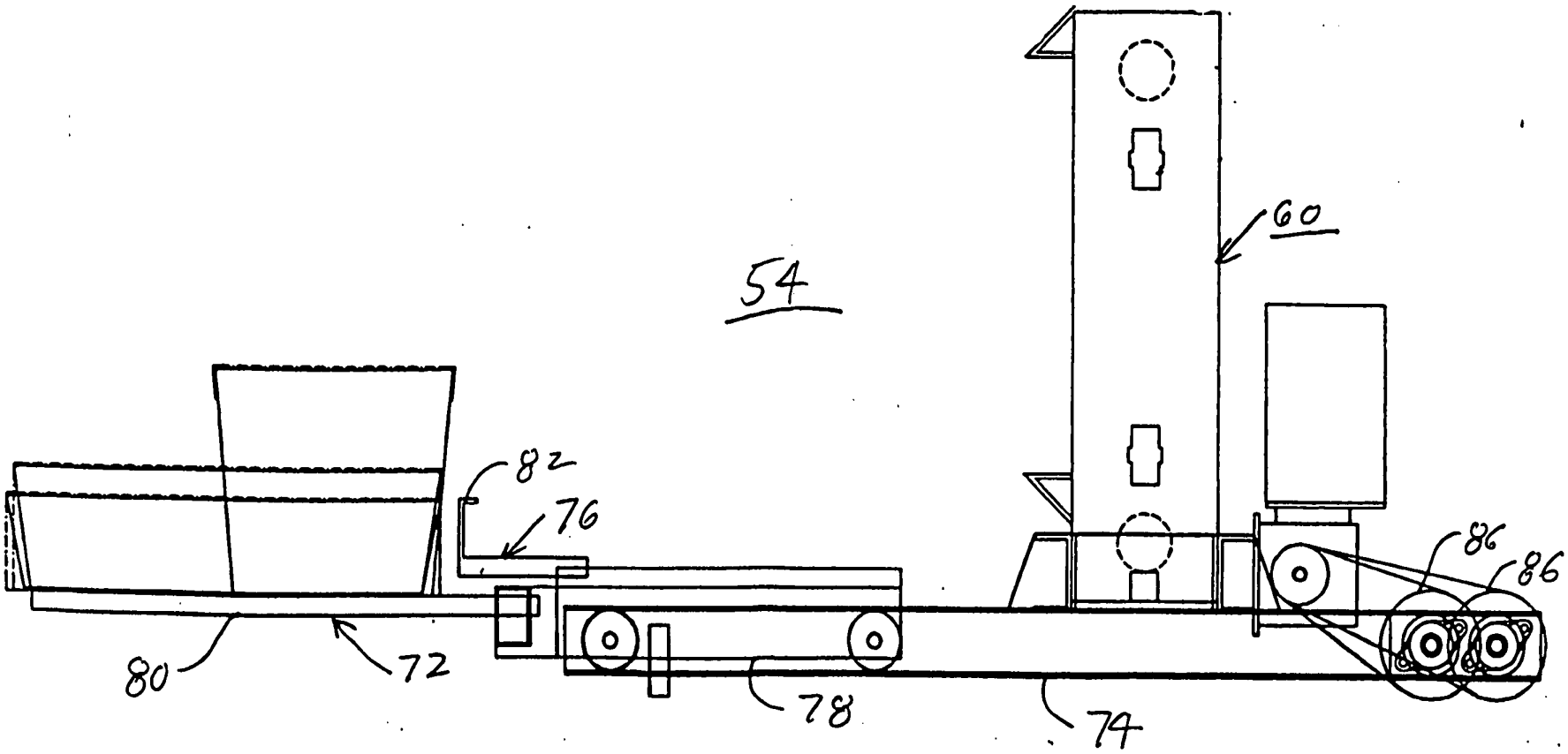


Fig 10

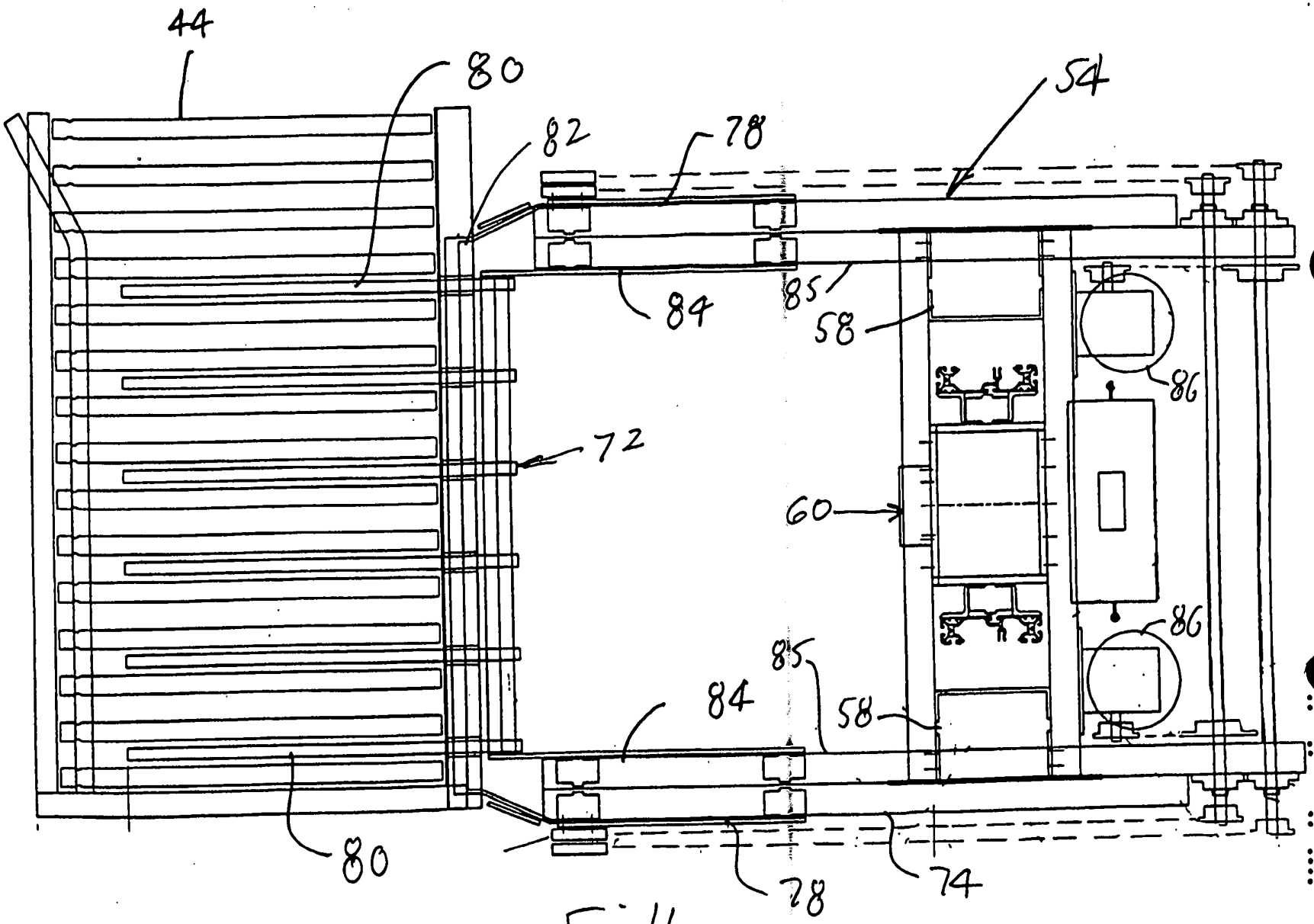


Fig 11

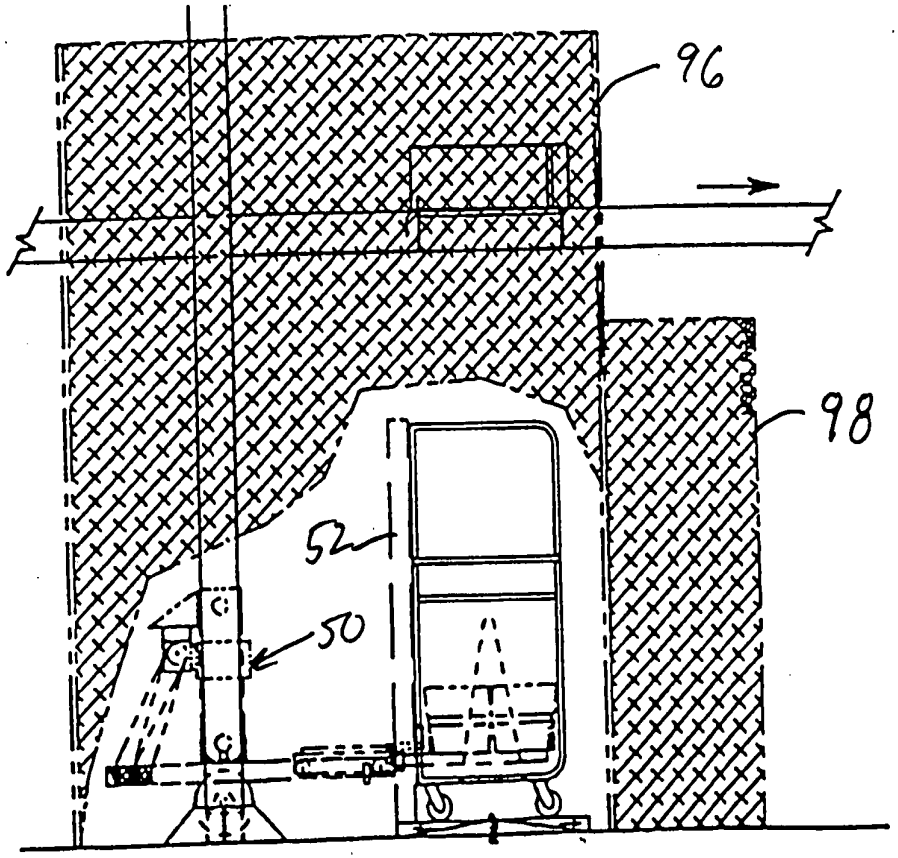


Fig 12

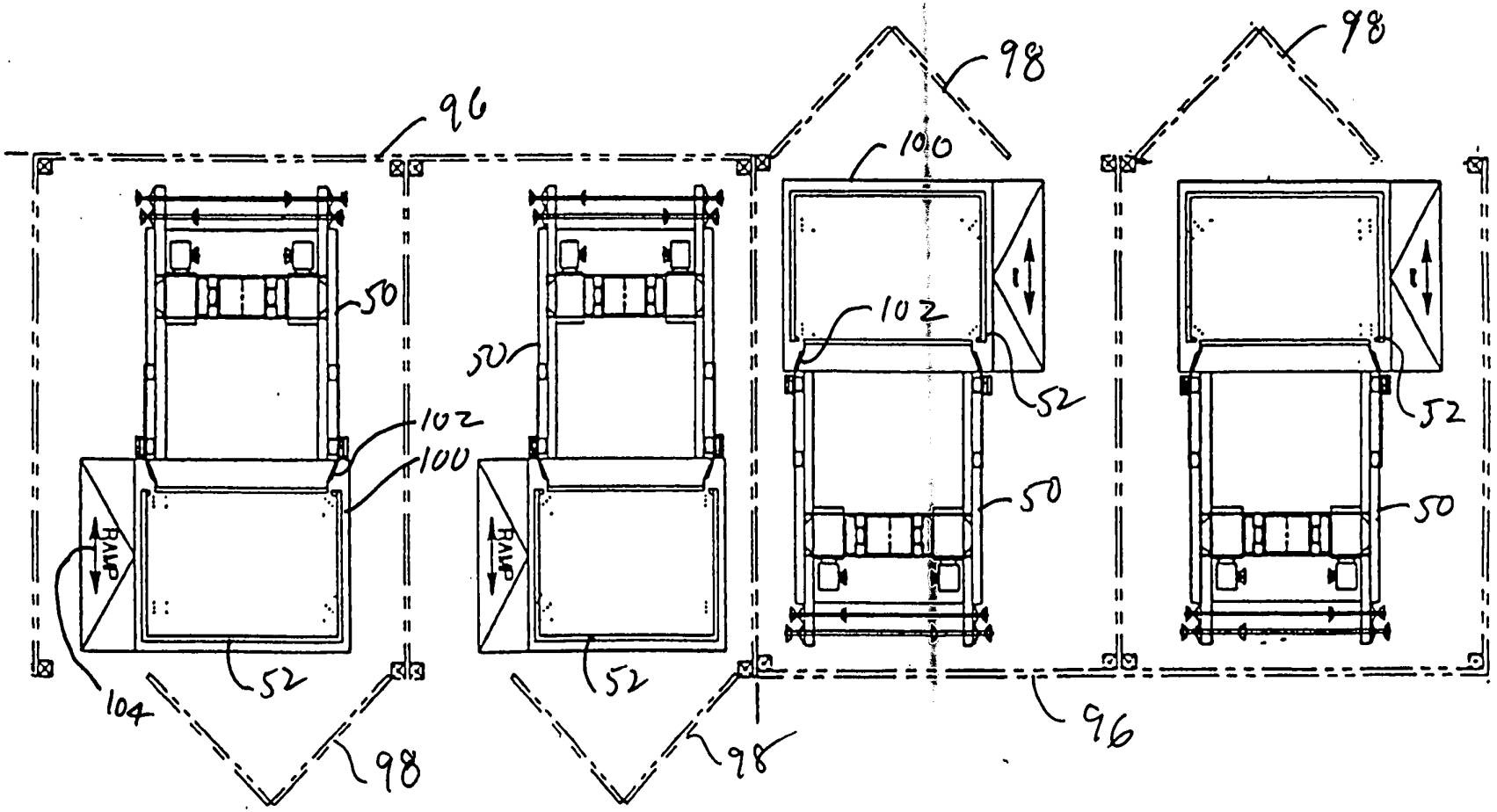


Fig 13

TRAYS TO BE HANDLED

(NTS)

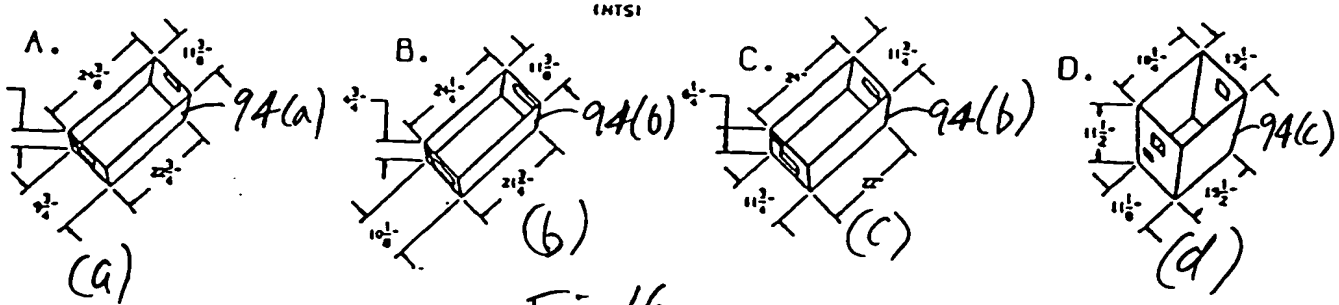


Fig 16

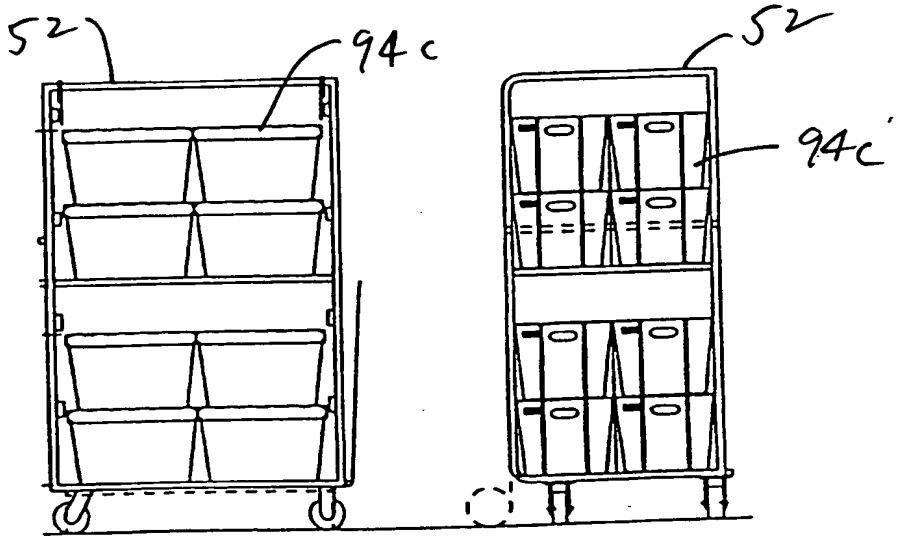


Fig 15

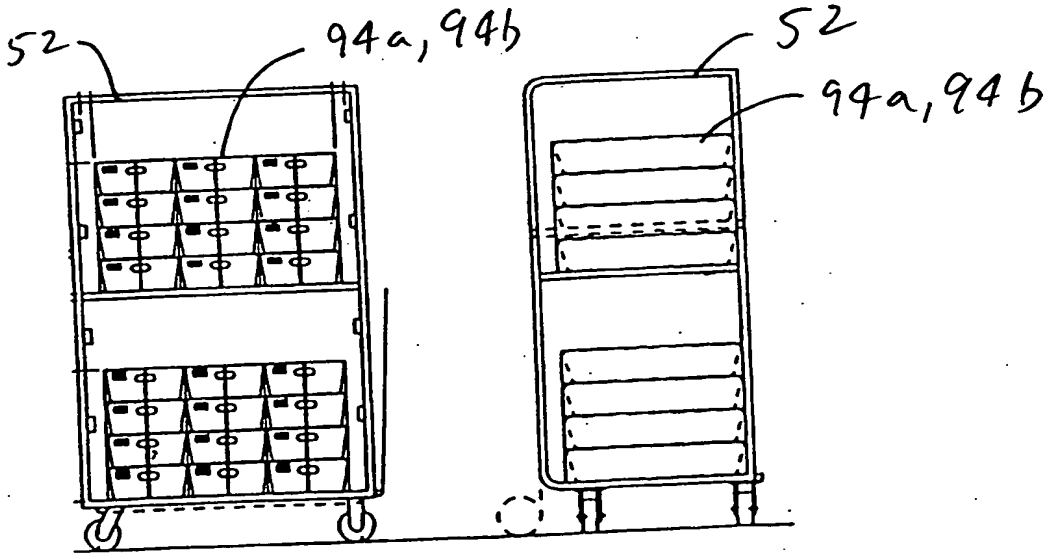


Fig 14

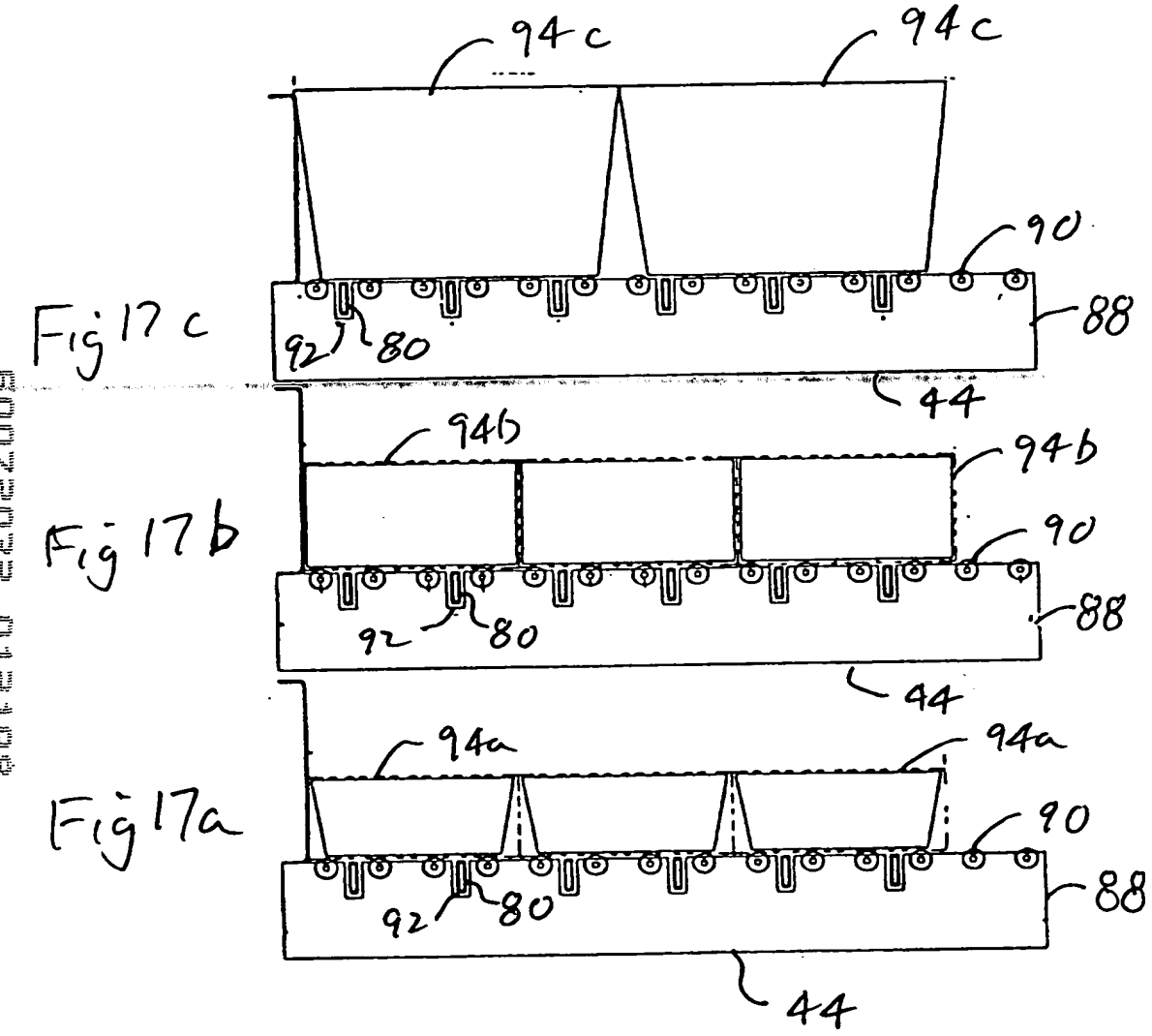


Fig 17c

Fig 17b

Fig 17a

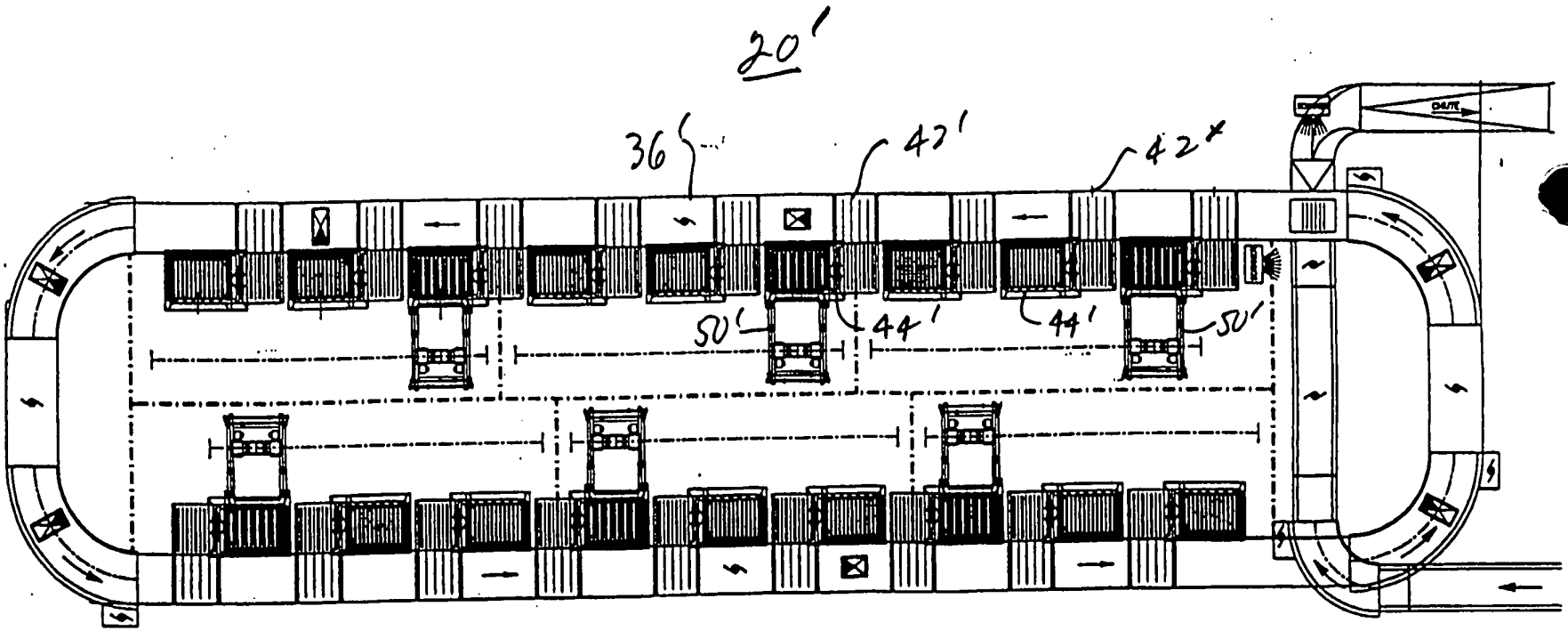


Fig 18